Smart Materials

BIT's 1st Annual World Congress of Smart Materials-2015

Theme: Co-creating Dream of Smartness

Time: March 23-25, 2015

Venue: Busan Exhibition & Convention Center, Republic of Korea

Conference
Abstract Book

Conference Report

BIT's 1st Annual World Congress of Smart Materials-2015 (WCSM-2015) has been successfully held in Busan, Republic of Korea on March 23-25, 2015, which achieved a consummation. The theme of this conference is “Co-creating Dream of Smartness”. Over 280 honored guests presented at this congress and gave brilliant invited speeches, among them the plenary keynote spekars are Dr. David Cardwell, Professor of University of Cambridge (UK); Dr. Chengbao Jiang, Dean of Materials Science and Engineering in Beihang University (China); Dr. Seung-Bok Choi, Professor of Inha University (Republic of Korea); Dr. Changwei Hu, Director of Key Laboratory of Green Chemistry and Technology and Dean of Office of Scientific Research Development in Sichuan University (China); Dr. Carl M. Lampert, Technical Director of SVC Society of Vacuum Coaters. More than 250 world-renowned professors, experts, project leaders and industrial representatives of well-known enterprises attended the conference.

This annual congress comprised 11 Chapters and 33 Sessions following the grand Opening ceremony and Keynote Forum, including Chapters of "Breaking Research of Smart Materials Science and Technologies"; "Properties Characterization of Smart Materials"; "Piezoelectric Materials"; "Smart Fluid, Hydrogels and Phase Change Materials"; "Shape-Memory Alloys & Shape-Memory Polymers"; “Smart Biomaterials”; "Application of Smart Materials"; "Smart Nanomaterials"; "Smart Material Design, Modeling, Synthesis and Processing" etc.

Meanwhile, the Young Scientists Forum is very successful as well as the over 50 exhibition and poster showcase. After the conference, many participants expressed their satisfaction with the content of the congress and had good memories of Busan and even joined in Korea Tour. Depending on the great support and suggestions from all of the participants, we are quite confident in organizing WCSM-2016 in Singapore which would be organized with more efforts. Suggestions are welcome all the time. Committee is looking forward to meeting you again in 2016! Please see WCSM-2016 in http://www.bitcongress.com/wcsm2016/default.asp.

Main Conference

Part 1: Opening Ceremony

Part 2: Smart Material Summit

Parallel Meetings

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Scientific and Tech Program

Chapter 1: Breaking Research of Smart Materials Science and Technologies

Chapter 2: Properties Characterization of Smart Materials

Chapter 3: Piezoelectric Materials

Chapter 4: Smart Fluid, Hydrogels and Phase Change Materials

Chapter 5: Shape-Memory Alloys & Shape-Memory Polymers

Chapter 6: Smart Biomaterials

Chapter 7: Application of Smart Materials

Chapter 8: Smart Nanomaterials

Chapter 9: Other Smart Materials

Chapter 10: Smart Material Design, Modeling, Synthesis and Processing

Young Investigator Hot Paper Briefing

Business, Market Trend and Career Development

Poster, Industrial Showcase and Exhibitions

Social Activities

Plenary Keynote Speakers and Partial Renowned Speakers

Dr. David Cardwell, Professor, University of Cambridge, UK

Dr. Carl M. Lampert, Technical Director, SVC Society of Vacuum Coaters, USA

Dr. Chengbao Jiang, Dean, Materials Science and Engineering, Beihang University, China

Dr. Seung-Bok Choi, Professor, Inha University, Republic of Korea

Dr. Kwang-Bum Kim, Professor, Yonsei University, Vice president, Korean Electrochemical Society, Republic of

Dr. Il Kim, Professor, BK 21 PLUS Center for Advanced Chemical Technology, Department of Polymer Science and Engineering, Pusan

Dr. Ivoyl Koutsaroff, Formerly at Murata Manufacturing Co. Ltd

Dr. Jamil Baghdachi, Professor, Eastern Michiga

Exhibition and Poster

WCSM-2015 provides an ideal platform to showcase your new technologies and products in Korea. It is developed to maximize your exposure, generate new leads, build brand awareness, and solidify business relations.

Why Reserve a Booth at WCSM-2015

- Meet with International Leaders and Senior Officers in the Field of Smart Materials
- Maximize Your Opportunities for Collaboration
- Explore Business Opportunities in Korea and beyond
- Spotlight Your Technologies and Its Commercial Application
- Superior Networking Opportunities with Senior Professionals and Industry Elites

Sponsorship

WCSM-2015 is one of the most effective international marketing platforms in the field of smart materials, which offers a wide range of sponsoring categories for branding and highlighting your company in order to achieve the best publicity.

Expand Your Business - A Cost Effective Sponsorship

- Get Cost and Time Effective Marketing Exposure and Boost Your Brand Recognition
- Set Up Stronger Alliances, New Partnerships
- Showcase Products and Services to a Targeted Prospects of Decision-makers
- Opportunity to Speak and Announce Recent Company Development
- Network from 800+ Professionals Offering Opportunities, before, during and after the Conference

Scenery of South Korea

Book Optional Tour>>

Busan is South Korea's second largest metropolis, with a population of approximately 3.6 million and it is the largest port city in South Korea and the world's fifth busiest seaport. Busan is known as the fourth best city among Asia's top convention cities.

More>>

Session 702: Smart Materials for Energy Storage and Energy Saving

Time: 13:00-16:55, March 24, 2015 (Tuesday); Place: Room 326, 3rd Floor, Exhibition Center II, BEXCO

Chair	***Dr. Kwang-Bum Kim,*** Professor. Yonsei University, Vice president. Korean Electrochemical Society, Republic of Korea
Co-Chair	***Dr. Qichao Hu,*** Founder / CEO, SolidEnergy Systems Corp., USA
13:00-13:20	***Keynote Speech***
	Title: *Graphene-based Composites for Electrochemical Capacitors*
	Dr. Kwang-Bum Kim, Professor. Yonsei University, Republic of Korea
13:20-13:40	***Keynote Speech***
	Title: *Recent Development on Molecular Hydrogen Storage in Nanomaterials in Korea*
	Dr. Jisoon Ihm, Professor. Seoul National University, Republic of Korea
13:40-14:00	***Keynote Speech***
	Title: *Anion-control Approach for Tuning of Dielectric Properties of Mixed-anion Perovskite Thin Film Materials*
	Dr. Ivoyl Koutsaroff, Formerly, Murata Manufacturing Co. Ltd
14:00-14:20	***Title:*** *Molecular Beam Epitaxial Growth of Large Area III-Nitride Nanowire Solar Cells on Silicon Substrates*
	Dr. Hieu P. T. Nguyen, Assistant Professor, New Jersey Institute of Technology, USA
14:20-14:40	***Title:*** *Graphene-based Anode Materials for Li-ion battery*
	Dr. Wei-Ren Liu, Assistant Professor, Chung Yuan Christian University, Taiwan
14:40-15:00	***Title:*** *Solid Polymer Ionic Liquid (SPIL) Electrolyte for Safe and High Energy Density Lithium Batteries*
	Dr. Qichao Hu, Founder / CEO, SolidEnergy Systems Corp., USA
15:00-15:15	**Coffee Break**
15:15-15:35	***Title:*** *Thin Film all Solid State Batteries–Status and Challenges for Electrolyte Materials*
	Dr. Eugen Stamate, Senior Scientist. Technical University of Denmark, Denmark
15:35-15:55	***Title:*** *Nanoparticle-Mediated Semiconductor Bonding for High-Efficiency Multi-Junction Solar Cells*
	Dr. Hidenori Mizuno, Staff, National Institute of Advanced Industrial Science and Technology, Japan
15:55-16:15	***Title:*** *Solution-Processed Plastic LEDs and Solar Cells usingSmart, Low-Temperature Oxide Electrodes*
	Dr. Dan Credgington, Research Fellow, University of Cambridge. UK
16:15-16:35	***Title:*** *Nature Energy Origin Micro Grid System and Solar to Chemical Energy Storage by Solar Cell and Electrochemical Cell*
	Dr. Katsushi Fujii, Professor. The University of Tokyo. Japan
16:35-16:55	***Title:*** *Flexible and Cost Effective High Efficiency Solar Cells*
	Dr. Abdulrahman M. Albadri, Assistant Research Professor, National Nanotechnology Center, King Abdulaziz City for Science and Technology, Saudi Arabia

Title: Anion-control Approach for Tuning of Dielectric Properties Mixed-anion Perovskite Thin Film Materials

Dr. Ivoyl P. Koutsaroff
Formerly at Murata Manufacturing Co. Ltd.

Abstract

In comparison to cationic substitutions or co-substitutions, anionic substitutions in perovskite materials are less systematically examined in regard to the dielectric properties of a given perovskite-type class compare to their oxide analogues. The exchange of the oxide ions for nitride ions can have a substantial influence on the structural, i.e., through rearrangement of $B(O,N)_6$ octahedra, and physical characteristics of perovskite materials and can allow creation of new mixed anion $AB(O,N)_3$ type perovskite derivatives. Most of mixed-anion perovskite material development activities had been historically triggered by search for more efficient photocatalytic water spitting materials or as non-toxic pigments, however, very recently the oxynitride perovskites have been shown to exhibit ferroelectric behavior. Typically studied oxynitride perovskite systetns in regard to their dielectric properties in a bulk ceramic or as thin films are $LaTiO_2N_l$, $SrTaO_2N_1$, $BaTaO_2N_1$ and $CaTaO_2N_1$. The incorporation of N^{3-} into the $AB(O,N)_3$ lattice results in a pronounced effects, such as elongated Ta(Ti)-N bond length and reduced electronegativity of the nitride ion, the rrjxed occupancy of the anion site in oxynitrides $AB(O_{1-x}N_x)_3$, provides a condition similar to that found in relaxor ferroelectrics, as the polarizing octahedral cations (Ti^{4+}) will experience random chemical environments due to the fact that nitrogen ions can occupy either adjacent (cis-type) or opposite (trans-type) sites in BO_4N_2 octahedra. Studies covering oxynitride alkaline earth metal titanate perovskite type dielectric thin films had been very limited and started about half a decade ago. The concept is based on an approach for effective reduction or avoidance of formation of additional anionic vacancies which is the simultaneous substitution of oxygen by nitrogen combined at the same time with simultaneous isovalent and aliovalent cosubstitutions for both A- and B-sublattices of the perovskite to allow achieving higher insulation resistance of the mixed anion perovskites while further enhancing the inherently high dielectric constants of the starting oxide alkaline earth metal titanates (typically ε~500 for 100 nm films) through lattice distortions. In the present study, we combined a comprehensive approach as we simulate theoretically by using Density Functional Theory (DFT) as well as we conducted experimental verification by using rf reactive co-sputtering at moderate temperatures range under $O_2/N_2/Ar$ gas mixture which allow us to apply rare-earth aliovalent substitution (RE^{3+}) of the A-site of the perovskite systems combined with a tetravalent or pentavalent transitional metal (co)substitution of the B-site and finally that also includes the aliovalent O^{2-}/N^{3-} substitution. The rf sputtered grown oxynitride films exhibit formation of nanosized N-rich clusters within the oxide perovskite matrix as it had been confirmed by HAADF-STEM EELS analysis. The N-containing clusters were dispersed homogeneously across the grain boundaries and within the columnar grains of the perovskite films which do remain in superparaelectric (nonpolar) state. The O^{2-}/N^{3-} substitution within the perovskite films also had been verified by XPS analysis and it can be influenced with the variation of the nitrogen/oxygen gas ratio within the sputtering plasma and with adjustments of the rf power level for each individual co-doping source material, as a result, various levels of the A-/B-co-doping concentrations and various nitrogen substitution levels had been achieved, which allowed achieving much wider range of control of their dielectric polarizabilities (nonlinearities): from 4:1 to 1.2:1 voltage tuning ratio under 0.4MV/cm electric field for all oxynitride films, while the dielectric losses remained very low, from 1.5% to 0.5% at 1KHz at 0 V and for all DC bias levels (up ±1.2 MV/cm). One of the unique aspects of the newly obtained A-/B-co-doped oxynitride perovskite thin films is the phenomenon associated with their dielectric constants which are substantially independent of the applied DC bias voltages.